Convergence of real per capita GDP within COMESA countries: A panel unit root evidence

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Abstract

This article examines the absolute and conditional convergence of real GDP per capita in the Common Market for Eastern and Southern Africa (COMESA) during the period 1950-2003. Income departures across countries were evaluated from several panel data unit root tests. We find no evidence supporting the existence of convergence process for the income in the COMESA. Nevertheless, applying economic development criterion allows to identity two absolute convergence clubs into the COMESA, one for the most four developed countries (Egypt, Libya, Mauritius, Seychelles), and one other for the fourteen less developed ones. Thus, we show that most economies of COMESA are locked into a sustained poverty trap process.

Keywords: Regional integration; convergence; Eastern and Southern Africa; panel unit root tests.

JEL Classification: F15; O40; C12; C23.

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1 Introduction

Testing real income convergence, i.e. convergence in per capita output across different economies, remains one of the most challenges in the contemporaneous international economic literature (Islam, 2003). On the whole, there are at least three main reasons that justify the interest of study this subject. Firstly, this exercise can help to discriminate between economic growth models. On the one hand, the neoclassical model predicts that per capita output will converge to each country's steady-state or to a common steady-state, regardless of its initial per capita output level (Solow, 1956). On the other hand, endogenous growth models, by underlining the importance of initial conditions and the possibility of multiple equilibriums, show that there is no tendency for income levels to converge in the long-run (Romer, 1986, 1990). Secondly, as a consequence of the above remark, whether or not the exogenous or the endogenous version is validated induces a potential for state intervention in the growth process. Thirdly, on the empirical side, strong differences have been observed in per capita output and in growth rates across countries during the last three decades, and especially between many African economies and emerging Asian and developed economies (Maddison, 2001).

Moreover, the wave of regionalism in the 1990s has spurred academic and professional interest towards the economic effects of regional integration agreements (hereafter, RIAs). Among these effects, a RIA is expected to strengthen trade links and hence to facilitate technological spillovers across borders. Then, income levels should converge and the initially poorer member states will catch up with the richer ones. However, in a recent theoretical article, Venables (2003) states that income dispersion across countries in a RIA will decrease only in the case of North-North integration (or at most North-South). On the contrary, South-South integration could easily lead to income divergence and unequal distribution of welfare gains.

Since the pioneer work of Baumol (1986) and Barro and Sala-i-Martin (1991, 1992), the test of the convergence hypothesis has consisted of fitting cross-country regressions. Convergence is said to occur if a negative correlation is found between the average growth rate and the initial income. However, Quah (1993, 1996) criticizes cross-country growth regression and shows that in order to evaluate the convergence hypothesis one must exploit the time series properties of the cross-country variances. Moreover, Bernard and Durlauf (1996) demonstrate that the cross-section growth regressions cannot discriminate between the hypotheses of global or local convergence. Then, Bernard and Durlauf (1995, 1996) propose to considering convergence as a

stochastic process, using the properties of time series, and test the convergence hypothesis from unit root tests. However, time-series unit root testing has been often criticized for its limited power and poor size properties (Haldrup and Jansson, 2006). The small number of observations available on the time-series dimension would then make the country-by-country analysis of income convergence in RIAs of recent formation particularly problematic. Therefore, Evans (1996) suggests exploiting both the time-series and the cross-section information included in the data of the per capita income in order to evaluate the convergence hypothesis. With this approach, the cross-sectional and time-series information are combined, thus inducing a significant improvement in terms of power of the test.

Only few studies (McCoskey, 2002; Paap et al., 2005; Carmignani, 2006; Cuñado and Pérez de Gracia, 2006; Guetat and Serranito, 2007; Carmignani, 2007) have been conducted to examine convergence in African countries and, in particular, in Eastern and Southern African economies. Therefore, this paper aims at pursuing investigations about economic growth convergence for the main RIA of Eastern and Southern Africa, namely the COmmon Market of Eastern and Southern Africa (hereafter, COMESA) but in an original way. We apply various panel unit root tests to real GDP per capita data for 20 Eastern and Southern African countries: first generation tests based on the assumption of independent cross-section units (Levin et al., 2002; Im et al., 2003); and second generation tests allowing for cross-section dependence (Bai and Ng, 2004).

More precisely, two main issues are investigated: (1) is there an intra-regional convergence process, i.e. relative to the average income level of the area, among COMESA's members?; (2) if not, are there any convergence clubs within the COMESA? Note that the idea of testing for convergence clubs is fundamentally linked to the concept of multiple equilibria, and so to the hypothesis of poverty trap (Kraay and Radatz, 2005). To this end two main criteria were used to test for convergence clubs: (i) the degree of human and economic development, and (ii) the nature of the export base (oil producers versus non-oil producers).

Note that empirical testing of the convergence hypothesis provides several definitions of convergence, and thus different methodologies to test it.[1] In the convergence debate, two definitions have emerged: the absolute convergence and the conditional convergence. The former occurs when the level of per capita income of the poor countries catch-up with the one of the rich ones. This can be achieved if the

[1] See Islam (2003) for a survey on the different definitions and methodologies relative to the concept of convergence.

growth rates of developing countries are significantly higher than those of developed countries. The latter implies that each country is converging to its own steady state and that in the long run all the growth rates will be equalized.

The remainder of the paper is organized as follows. Section 2 proposes a survey of the recent empirical works dealing with real income convergence in Eastern and Southern African countries. Section 3 briefly displays the econometric strategy retained and the convergence hypothesis considered, and describes the panel unit root tests. Section 4 presents the data and the main findings. Finally, Section 5 concludes.

2 Brief literature survey

The COMESA is a regional integration grouping of African states (Angola, Burundi, Comoros, Democratic Republic of Congo, Djibouti, Egypt, Eritrea, Ethiopia, Kenya, Libya, Madagascar, Malawi, Mauritius, Rwanda, Seychelles, Sudan, Swaziland, Tanzania, Uganda, Zambia and Zimbabwe) which have agreed to promote regional integration through trade development and to develop their natural and human resources for the mutual benefit of all their peoples. One of the six objectives of COMESA as enshrined in the COMESA Treaty is to contribute towards the establishment of the African Economic Treaty.[2]

COMESA was initially established in 1981 as the Preferential Trade Area (hereafter, PTA) for Eastern and Southern Africa, within the framework of the Organisation of African Unity's Lagos Plan of Action and the Final Act of Lagos. The PTA was transformed into COMESA in 1994. It was established to take advantage of a larger market size, to share the region's common heritage and destiny and to allow greater social and economic cooperation, with the ultimate objective being to create an economic community.

The empirical literature highlights many works which focus on the problem of

[2]The five others objectives is to to create and maintain: (i) a full free trade area guaranteeing the free movement of goods and services produced within COMESA and the removal of all tariffs and non-tariff barriers; (ii) a customs union under which goods and services imported from non-COMESA countries will attract an agreed single tariff in all COMESA states; (iii) free movement of capital and investment supported by the adoption of a common investment area so as to create a more favorable investment climate for the COMESA region; (iv) a gradual establishment of a payment union based on the COMESA Clearing House and the eventual establishment of a common monetary union with a common currency; and (v) the adoption of common visa arrangements, including the right of establishment leading eventually to the free movement of bona fide persons.

the economic growth process in Africa (e.g., Easterly and Levine, 1997; Bloom and Sachs, 1998; Collier and Gunning, 1999; Block, 2001; Bertocchi and Canova, 2002). However, little attention has been paid to the real convergence process both among the countries within the African continent and with respect to developed countries. On this subject, five papers (McCoskey, 2002; Paap et al., 2005; Carmignani, 2006; Cuñado and Pérez de Gracia, 2006; Carmignani, 2007) must be presented.

Firstly, McCoskey (2002) investigates the convergence properties of six indicators of well being for 37 Sub-Saharan African countries.[3] Using of both the panel unit root test of Im et al. (2003) and the panel cointegration test of McCoskey and Kao (1998), applied to pair-wise income differentials, McCoskey finds no evidence of time series convergence across the whole sample for the real GDP-based variables. Moreover, this finding still holds even for more homogeneous groups of economies sharing some institutional arrangements such as the Southern African Development Community (SADC) and the Southern African Customs Union (SACU).[4]

Paap et al. (2005) address the question whether or not Sub-Saharan African countries have lower average growth rates in real per capita GDP than countries in Asia, Latin America and the Middle East over the period 1960-2000. To this regard, they propose a latent-class panel time series model, which allows a data-based classification of countries into clusters such that, within a cluster, countries have the same average growth rate. Then, three clusters or three convergence clubs can be put forward, and many Eastern and Southern African countries belong to the low growth cluster. Only Egypt, Mauritius, Malawi, Seychelles and Zimbabwe can be assigned to the middle growth class and none belong to the high growth cluster.

Carmignani (2006) focuses on the problem of macroeconomic convergence for the COMESA. The author analyzes the hypothesis of real income convergence, among others[5], using data covering the period 1960-2002. Two measures of convergence based on cross-country regression are computed. The first one, called σ-convergence, corresponds to the standard deviation of per capita real GDP across member states. The

[3]These indicators are (i) the government share of GDP measured in 1985 international prices, (ii) the capital stock per worker, (iii) a measurement of exports added to imports as a fraction of GDP (all measured in current prices) (iv) a measure of real GDP per capita at 1985 international prices, (v) a measurement of consumption added to government expenditure as a % of GDP and (vi) a measure of real GDP per worker at 1985 international prices.

[4]The SADC was established in 1992 and consists of ten countries (Angola, Botswana, Lesotho, Malawi, Mozambique, South Africa, Swaziland, Tanzania, Zambia, Zimbabwe). The SACU was created in 1910 and consists of five countries (Bostwana, Lesotho, Namibia, South Africa, Swaziland).

[5]The author studies the degree of convergence of macroeconomic policy across members and the issue of whether COMESA is an optimal currency area.

second one, called β-convergence, is the estimated coefficient on initial (or lagged) per capita GDP in a regression of the rate of per capita GDP growth. Carmignani concludes that income does not appear to converge across COMESA member states. On the contrary, the gap between poorer and richer countries in the region is widening and overall distribution is probably evolving towards a bi-modal configuration.

In a more general article, Cuñado and Pérez de Gracia (2006) apply time series tests to analyze both the stochastic and β-convergence conditions of per capita output of 43 African countries to an average of the African countries and with respect to the US economy using data for the period 1950-1999. If we just consider the results for Eastern and Southern African area, this work finds the evidence of conditional convergence only for the case of Seychelles towards the US economy. When the catch-up hypothesis is retained, i.e. by taking into account a time trend when testing the unit root hypothesis, more evidence of convergence towards the African average (Djibouti, Egypt, Kenya, Uganda and Zimbabwe) and towards the US economy (Egypt, Mauritius, and Seychelles) is found.

Finally, Carmignani (2007) investigates the extent of per capita income convergence in regional integration initiatives. To this end, panel unit root testing, developed by Im et al. (2003), is performed on 28 regional groupings among which several agreements of Eastern and Southern Africa (CBI[6], COMESA, SACU, SADC). On the whole, it appears that per capita income convergence is not necessarily a prerogative of North-North integration. This hypothesis holds also for several South-South initiatives. However, this optimistic remark on the convergence properties of South-South integration needs to be qualified. In some cases, cross-country convergence appears to be taking place around a relatively flat regional growth trend. That is, while countries in some South-South RIAs do converge towards the regional average, this regional average fails to catch-up with industrial countries' income. Conversely, there are RIAs whose average income is catching-up with industrial economies, but member states fail to converge to the regional mean. Moreover, the author shows that South-South integration does not necessarily imply widening intra-regional disparities. However, it might lead to a form of convergence to the bottom.

[6]The CBI was established in 1992 and consists of fourteen countries (Burundi, Comoros, Kenya, Madagascar, Malawi, Mauritius, Namibia, Rwanda, Seychelles, Swaziland, Tanzania, Uganda, Zambia, Zimbabwe).

3 The panel data framework

Nowadays, the increasing application of the panel data techniques to the determination of time-series stochastic properties has led to the development of a wide range of new proposals in the econometric literature. The combination of the information in the time and cross-section dimensions to compose a panel data set of individuals, i.e. countries or regions, onto which performs the analysis of the stochastic properties has revealed as a promising way to increase the power of these tests. The emergence of new econometric methods has led economists to focus on the convergence debate (Gaulier, Hurlin and Jean-Pierre, 1999; Carmignani, 2007; Guetat and Serranito, 2007; Lima and Resende, 2007).

3.1 The income convergence hypothesis: absolute versus conditional convergence

Several researchers have focused on the definition of the convergence concept in a stochastic framework (e.g., Carlino and Mills, 1993; Bernard and Durlauf, 1996; Evans, 1996; Evans and Karras, 1996; Guetat and Serranito, 2007). Islam (2003) showed that this definition is relatively unambiguous for a two-economy situation. However, things are different when convergence is considered in a sample of more than two economies. Then, some authors based their analysis of convergence on deviations from a reference economy although others authors opted for deviations from the sample average. Following the work of Evans and Karras (1996) and Guetat and Serranito (2007), we choose the second viewpoint.

Consider a sample of economies $1,2,\ldots,N$ that have access to the same body of technological knowledge. For each economy, the convergence hypothesis implies that a unique steady state exists, that any deviation of the state variables from their long run values is temporary, and hence that initial values of the state variables have no effects on their long run levels. The common technical knowledge assumption further implies that the balanced growth paths of the N economies are parallel: the state variables can differ only by constant amounts. Conversely, the N economies diverge if the deviations from the steady state are permanent, and hence the initial values impact in the long run their levels.

Then, in a stochastic framework, economies $1,2,\ldots,N$ are said to converge if, and

only if, a common trend a_t[7] and finite parameters $\mu_1, \mu_2, \ldots, \mu_N$ exist such that:

$$\lim_{i \to \infty} E_t(y_{n,t+i} - a_{t+i}) = \mu_n \tag{1}$$

for $n = 1, 2, \ldots, N$, and y_{nt} is the logarithm of per capita output for economy n during period t. The parameter μ_n determines the level of economy n's parallel balanced growth path. Unless all economies have identical structures, the μ's should typically be nonzero.

Unfortunately, the common trend is unobservable. However, under the convergence hypothesis, an estimator of its value can be obtained. Indeed, if the deviations from the steady state are not permanent, then the cross-economy average of the per capita income must converge to the level of the common trend:

$$\lim_{i \to \infty} E_t(\bar{y}_{t+i} - a_{t+i}) = 0 \tag{2}$$

where $\bar{y}_t = \sum_{n=1}^{N} y_{n,t}/N$. Finally, Evans and Karras (1996) obtained the following condition:

$$\lim_{i \to \infty} E_t(y_{n,t+i} - \bar{y}_{t+i}) = \mu_n \tag{3}$$

According to this assumption, the deviations of $y_{1,t+i}$, $y_{2,t+i}$, ..., $y_{N,t+i}$ from their cross-economy average $\bar{y}_t$ can be expected, conditional on current information to approach constant values as i approaches infinity. Note that this condition holds if, and only if, $(y_{n,t} - \bar{y})$ have exhibited a much higher growth rate than the richer ones, and hence that a catching-up is occurring. On the other hand, the convergence will be said conditional if $\mu_n \neq 0$ for some n. So, each economy has converged to its own steady state, and only the growth rates will be equalized in the long run. Operationally, these income convergence hypotheses require testing for the presence of a unit root in panel data. The absolute convergence is tested by panel unit root tests with no fixed individual effects, whereas the conditional convergence is tested by implementing panel unit root tests with fixed individual effects.

[7] The series a_t can be thought of as the logarithm of an index of Harrod-neutral technology available to economies $1, 2, \ldots, N$.

3.2 Panel unit root tests

In this study, we apply two first generation tests proposed by Levin et al. (2002) and Im et al. (2003) which are homogeneous and heterogeneous panel unit root tests, respectively, based on the assumption of independent cross-section units. In Levin et al. (2002), the alternative hypothesis is that no series contains a unit root (all are stationary) while in Im et al. (2003) the alternative allows unit roots for some (but not all) of the series.[8] However, the cross-unit independence assumption of the first generation tests is quite restrictive in many empirical applications and can lead to severe size distortions (Banerjee et al., 2005; Breitung and Das, 2008). Therefore, we also consider a second generation unit root tests that allow cross-unit dependencies with the tests developed by Bai and Ng (2004). The simplest way consists in using a factor structure model. The idea is to shift data into two unobserved components: one with the characteristic that is cross-sectionally correlated and one with the characteristic that is largely unit specific. Thus, the testing procedure consists in two steps: in a first one, data are de-factored, and in a second step, panel unit root test statistics based on de-factored data and/or common factors are then proposed. The issue is to know if this factor structure allows obtaining clear cut conclusions about stationarity of macroeconomic variables.[9]

3.2.1 Levin, Lin and Chu (2002) test

One of the most popular first generation unit root test is undoubtedly the test proposed by Levin, Lin and Chu (2002) (hereafter, LLC). The model with individual effects and no time trends, in which the coefficient of the lagged dependent variable is restricted to be homogenous across all units of the panel, is defined as

$$\Delta y_{it} = \alpha_i + \rho_i y_{i,t-1} + \sum_{z=1}^{p_i} \beta_{i,z} \Delta y_{i,t-1} + \varepsilon_{it} \tag{4}$$

for $i = 1,\ldots,N$ and $t = 1,\ldots,T$. The errors $\varepsilon_{it} \sim i.i.d.\ (0;\sigma^2_{\varepsilon i})$ are assumed to be independent across the units of the sample. In this model, LLC are interested in testing the null hypothesis H_0: $\rho = 0$ against the alternative hypothesis H_1: $\rho = \rho_i = \rho_i < 0$ for all $i = 1,\ldots,N$, with auxiliary assumptions about the individual effects ($\alpha_i = 0$

[8] See Hlouskova and Wagner (2006) for a discussion on the performance of first generation panel unit root tests.

[9] See Banerjee (1999), Baltagi and Kao (2000), Choi (2006), Breitung and Pesaran (2008) and Hurlin (2010) for a survey on panel unit root tests. See also Gengenbach et al. (2010) and de Silva et al. (2009) for an investigation on the properties of the second generation panel unit root tests.

for all $i = 1, \ldots, N$ under H_0). This restrictive alternative hypothesis implies that the autoregressive parameters are identical across the panel.

The LLC test is based on the following adjusted t-statistic

$$t_\rho^* = \frac{t_\rho}{\sigma_T^*} - NT\hat{S}_N \left(\frac{\hat{\sigma}_{\hat{\rho}}}{\hat{\sigma}_{\hat{\varepsilon}}^2} \right) \left(\frac{\mu_T^*}{\sigma_T^*} \right) \tag{5}$$

where t_ρ is the standard t-statistic based on the pooled estimator $\hat{\rho}$, where the mean adjustment μ_T^* and standard deviation adjustment σ_T^* are simulated by LLC for various sample sizes T. The adjustment term is also function of the average of individual ratios of long-run to short-run variances, $\hat{S}_N = (1/N)\sum_{i=1}^{N}(\hat{\sigma}_{y_i}/\hat{\sigma}_{\varepsilon_i})$, where $\hat{\sigma}_{y_i}$ denotes a kernel estimator of the long-run variance for the country i. LLC suggest using a Bartlett kernel function and a homogeneous truncation lag parameter given by the simple formula $\bar{K} = 3.21T^{1/3}$. They demonstrate that, under the non stationary null hypothesis, the adjusted t-statistic t_ρ^* converges to a standard normal distribution.

3.2.2 Im, Pesaran and Shin (2003) test

Im, Pesaran and Shin (2003) (hereafter, IPS) propose heterogeneous panel unit root tests based on the cross-sectional independence assumption. The model with individual effects and no time trend is given as

$$\Delta y_{it} = \alpha_i + \rho_i y_{i,t-1} + \sum_{z=1}^{p_i} \beta_{i,z} \Delta y_{i,t-1} + \varepsilon_{it} \tag{6}$$

The null hypothesis is defined as H_0: $\rho_i = 0$ for all $i = 1, \ldots, N$ and the alternative is H_1: $\rho_i < 0$ for $i = 1, \ldots, N_1$ and $\rho_i = 0$ for all $i = N_1 + 1, \ldots, N$, with $0 < N_1 \leq N$. The alternative allows unit roots for some (but not all) of the individuals. In this context, the IPS test is based on the (augmented) Dickey-Fuller statistics averaged across groups. Let $t_{iT}(\rho_i, \beta_i)$ with $\beta_i = (\beta_{i,1}, \ldots, \beta_{i,\rho_i})$ denote the t-statistics for testing unit root in the i-th country. The IPS statistic is then defined as

$$tbar_{NT} = \frac{1}{N}\sum_{i=1}^{N} t_{iT}(\rho_i, \beta_i) \tag{7}$$

Under the assumption of cross-sectional independence, this statistic is shown to sequentially converge to a normal distribution. IPS propose two corresponding standardized $tbar$ statistics. The first one, denoted Z_{tbar}, is based on the asymptotic

moments of the Dickey Fuller distribution. The second standardized statistic, denoted W_{tbar}, is based on the means and variances of $t_{iT}(\rho_i, 0)$ evaluated by simulations under the null $\rho_i = 0$. Although the tests Z_{tbar} and W_{tbar} are asymptotically equivalent, simulations show that the W_{tbar} statistic, which explicitly takes into account the underlying ADF orders in computing the mean and the variance adjustment factors, performs much better in small samples. For each country, the values of the mean and variance used in the standardization of W_{tbar} are taken from the IPS simulations (Im, Pesaran and Shin, 2003) for the time length T and the corresponding individual lag order p_i. Individual ADF lag orders are optimally chosen according to the general-to-specific (GS) procedure of Hall (1994) with a maximum lag length set to 4.[10]

3.2.3 Bai and Ng (2004) test

The unit root tests developed by Bai and Ng (2004) (hereafter, BN) provide a complete procedure to test the degree of integration of series. They decompose a series y_{it} as a sum of three components: a deterministic one, a common component expressed as a factor structure and an error that is largely idiosyncratic. The process y_{it} is non-stationary if one or more of the common factors are non-stationary, or the idiosyncratic error is non-stationary, or both. Instead of testing for the presence of a unit root directly in y_{it}, BN propose to test the common factors and the idiosyncratic components separately. Let us consider a model with individual effects and no time trend

$$y_{it} = \alpha_i + \lambda_i' F_t + \varepsilon_{it} \tag{8}$$

where F_t is a $r \times 1$ vector of common factors and λ_i is a vector of factor loadings. Among the r common factors, we allow r_0 stationary factors and r_1 stochastic common trends with $r_0 + r_1 = r$. The corresponding model in first differences is

$$\Delta y_{it} = \lambda_i' f_t + z_{it} \tag{9}$$

where $z_{it} = \Delta\varepsilon_{it}$ and $f_t = \Delta F_t$ with $E(f_t) = 0$. The common factors in Δy_{it} are estimated by the principal component method. Let us denote $\hat{f}_t$ these estimates, $\hat{\lambda}_i$ the corresponding loading factors and $\hat{z}_{it}$ the estimated residuals. BN propose a differencing and re-cumulating estimation procedure which is based on the cumulated variables

[10] Similar results have been obtained when individual lag lengths are chosen by information criteria (AIC or BIC).

$$\hat{F}_{mt} = \sum_{s=2}^{t} \hat{f}_{ms} \qquad \hat{\varepsilon}_{it} = \sum_{s=2}^{t} \hat{z}_{ms} \tag{10}$$

for $m = 1,\ldots,r$ and $i = 1,\ldots,N$. Then, they test the unit root hypothesis in the idiosyncratic component ε_{it} and in the common factors F_t with the estimated variables $\hat{F}_{mt}$ and $\hat{\varepsilon}_{it}$.

To test the non-stationarity of idiosyncratic components $\hat{\varepsilon}_{it}$ (the de-factored estimated components), BN suggest pooled individual ADF t-statistics from a Fisher's type statistic, denoted $P^c_{\hat{\varepsilon}}$, rather than individual ADF t-statistics $\text{ADF}^c_{\hat{\varepsilon}}(i)$ in order to improve the power of the test (BN, 2004).

To test the non-stationarity of the common factors $\hat{F}_{mt}$, BN consider a ADF t-statistic, denoted $\text{ADF}^c_{\hat{F}}(i)$, when there is only one common factor among the N variables ($r = 1$). The number of common factors is estimated according to IC_2 or BIC_3 criteria (see Bai and Ng, 2002) with a maximum number of factor equal to 5.[11]

4 Empirical analysis

4.1 The data

The data of the study consists of annual real per capita GDP data from Maddison (2007) database for 20 COMESA economies in common 1990 Geary-Khamis PPP-adjusted dollars, and spans from 1960 to 2003. Note that these data are expressed in common 1990 Geary-Khamis PPP-adjusted dollars, which correct for the differences in prices of commodities across countries.[12] The countries represented are Angola, Burundi, Comoros, Democratic Republic of Congo, Djibouti, Egypt, Eritrea, Ethiopia[13], Kenya, Libya, Madagascar, Malawi, Mauritius, Rwanda, Seychelles, Sudan, Swaziland, Tanzania, Uganda, Zambia, Zimbabwe. Note that all variables are expressed in logs (see figures 2 and 3). Moreover, output differentials are defined with respect to the corresponding panel average.

Before implementing the unit root tests, we first look at the shape of the regional distribution of outcomes within the COMESA. This exercise must gives us an idea

[11] BN (2004) also consider the case when there are more than one common factors ($r > 1$) from a sequential procedure. In our study, we find only one common factor.

[12] See Maddison (2003) for a discussion on the Geary-Khamis approach.

[13] Ethiopia and Eritrea are added into one item Eritrea–Ethiopia.

on the potential presence of a multiple equilibria configuration. So, we report in Figure (1) the distribution of real per capita GDP (in logs) across the set of Eastern and Southern African countries in 1960, 1980 and 2003. The plotted distributions are kernel density estimates based on a Epanechnikov kernel.[14] Then, a number of features can be put forward. Firstly, the distribution did not change obviously during the last five decades. Interestingly, this latter corresponds to the so-called "twin peaks" phenomenon highlighted by Quah (1993), Jones (1997) and Beaudry et al. (2005). This result seems to indicate that there is a bimodal distribution of output per capita leading to two different modes of convergence into the COMESA. Secondly, we observe that the first hump has shifted toward the left, indicating that a large part of countries are converging to a deteriorating average outcome per capita. Moreover, the distribution around the second hump is wider, suggesting a more and more ambiguous evidence about convergence between the richest economies of the sample.

However, one drawback in Figure (1) is that individual countries can not be isolated. So, in addition, we check if there are some exogenous[15] convergent clubs in the COMESA by analyzing some groups of COMESA countries. Note that the notions of “convergence clubs” and “poverty or underdevelopment trap” are closely linked. The first one relies on the idea that, although no absolute or conditional convergence[16] of economies toward a similar path of development is observable (there is no global convergence), one still might observe some local convergence properties. Similarly, there are convergence clubs if countries have globally heterogeneous growth dynamics, but can be grouped in subsets that show homogeneous growth patterns. Then, all countries belonging to one specific club are characterized by the same kind of equilibrium within a multiple equilibrium setting (Berthélemy, 2005). Finally, economies concerned by the lower equilibrium are in a long-lasting situation of poverty trap. Evidence on poverty traps has been extensively discussed in the empirical

[14] All distributions are expressed as deviations from the given year’s mean. Moreover, we use a bandwidth parameter given by $h = 0.9kN^{-(1/5)}min(s,(IQR)/1.34)$ where N is the number of observations, s is the standard deviation, IQR is the interquartile range of the series, and k is a canonical bandwidth-transformation.

[15] See Beine and Jean-Pierre (2000) for an endogenous determination of the convergence clubs.

[16] Precise that one must not make the confusion between the notions of "conditional convergence" and "convergence clubs". Indeed, although the former one implies that economies converge to different steady states, their growth processes can be represented using the same model contrary to the latter concept. Then, following the words of Berthélemy (2005), "instead of proper multiple equilibria, one would observe multiple variants of the same equilibrium, parameterized by the conditioning variables" (Berthélemy, 2005, p.6).

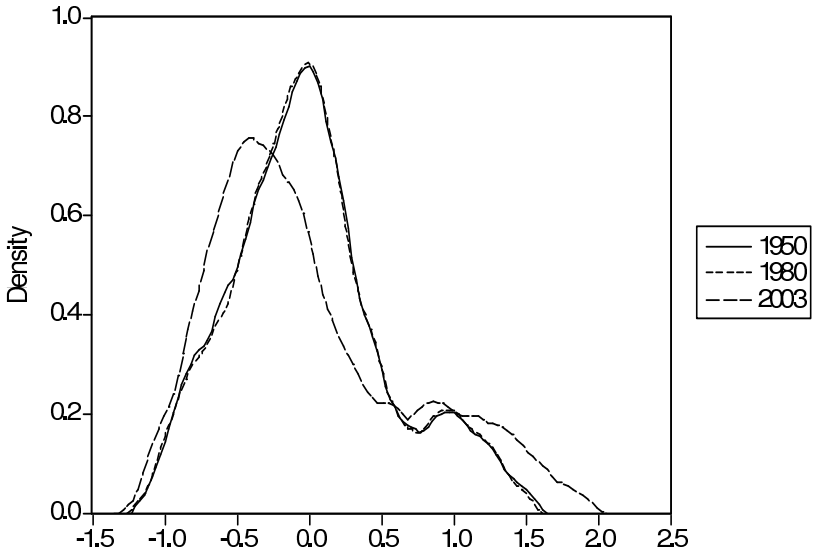

Figure 1: Cross-country real per capita GDP distribution: 1950, 1980 and 2003

literature (Abramovitz, 1986; Baumol, 1986; Quah, 1997; Hausmann et al., 2004; among others), and several sources of multiple equilibria have been put forward (Berthélemy, 2005).[17]

In this article, we focused on the two following criteria (Table 1):

(i) the degree of economic development: The importance of economic development (human capital, health, infrastructure, ...) have been demonstrated since a long time ago (Gillis et al., 1987). Recently, the New Growth Theory insisted on the crucial impact of the initial development conditions for economic growth and convergence. For that purpose, we first focused on the classification of the United Nations Development Program based on the Human Development Indicator (hereafter, HDI). This indicator has the decisive advantage of including two main sources of poverty trap, namely education and income per capita levels (Durlauf and Johnson, 1995). Otherwise, we fixed a threshold value of 0.6 so that we have two homogeneous groups: the High/Moderate Human Development Indicator (hereafter, HMHDI) group and the relatively Low

[17]The author gives a good survey on the different theoretical insights about the generating factors of multiple equilibria. Globally, one can mention (i) the process of capital accumulation, (ii) the role of human capital, and particularly of education, (iii) productivity gains related to research and development activities, (iv) the financial deepening process, (v) the output diversification process, and (vi) the institutional framework (corruption and civil strife).

Human Development Indicator (hereafter, LHDI). We also retained the concept of Less Developed Countries (hereafter, LDC) established by the United Nation Conference on Trade and Development.[18]

(ii) the economic diversification (Feenstra et al., 1999), and more precisely here the importance of oil in the production and the export structures: Most countries belonging to COMESA have a poor diversified export base. Some of them strongly depend on oil resources. One more time, we can build two groups from this criterion: the oil countries group, that is to say those which belong to the African Petroleum Producers Association (hereafter, APPA) and the non-oil countries group (hereafter, Non-APPA).

Table 1: COMESA's countries shaped following three criteria.

Regional integration agreement	Country
COMESA	Angola, Burundi, Comoros, Democratic Republic of Congo, Djibouti, Egypt, Eritrea–Ethiopia, Kenya, Libya, Madagascar, Malawi, Mauritius, Rwanda, Seychelles, Sudan, Swaziland, Tanzania, Uganda, Zambia, Zimbabwe
Economic development criterion	**Country**
HMIDH	Egypt, Libya, Mauritius, Seychelles
LHDI	Angola, Burundi, D.R. Congo, Comoros, Djibouti, Eritrea–Ethiopia, Kenya, Madagascar, Malawi, Rwanda, Sudan, Swaziland, Tanzania, Uganda, Zambia, Zimbabwe
LDC	Angola, Burundi, D.R. Congo, Comoros, Djibouti, Eritrea–Ethiopia, Madagascar, Malawi, Rwanda, Sudan, Tanzania, Uganda, Zambia
Economic structure criterion	**Country**
APPA	Angola, D.R. Congo, Egypt, Libya, Sudan
Non-APPA	Burundi, Comoros, Djibouti, Eritrea–Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Rwanda, Seychelles, Swaziland, Tanzania, Uganda, Zambia, Zimbabwe

[18]Note that a country is classified as a LDC if it meets three criteria based on: (i) low-income (three-year average GNI per capita of less than US $750, which must exceed $900 to leave the list), (ii) human resource weakness (based on indicators of nutrition, health, education and adult literacy) and (iii) economic vulnerability (based on instability of agricultural production, instability of exports of goods and services, economic importance of non-traditional activities, merchandise export concentration, and handicap of economic smallness, and the percentage of population displaced by natural disasters).

4.2 Panel unit root tests

The adopted strategy to test for income convergence is straightforward. Firstly, for each group, we apply panel unit root tests with no fixed individual effects in order to check if an absolute convergence process is present in the sample considered. Secondly, for the groups where the null of unit root can not be rejected, the same panel unit root tests but with fixed individual effects are implemented to pin downs a possible conditional convergence dynamics. Finally, if the unit root hypothesis always holds, then we consider that the group is characterized by stochastic divergence. We apply the following panel unit root tests: (i) with no individual effects suggested by Levin et al. (2002) [LLC_1, t^*_ρ], and (ii) with individual effects by Levin et al. (2002) [LLC_2, t^*_ρ], Im et al. (2003) [IPS, $tbar_{NT}$] and Bai and Ng (2004) [BN_c and BN_i for common factors ($\text{ADF}^c_{\hat{F}}$) and idiosyncratic shocks ($P^c_{\hat{\varepsilon}}$), respectively.].

Table 2 reports the panel unit root tests for the COMESA as well as from other income references (an African average and a World average). The results shows no evidence of absolute and conditional convergence. However, note that this finding of no convergence process for the trade arrangement criterion does not reveal that regional integration is not an efficient strategy to make developing countries to converge. In our point of view, this result just tells us that the ongoing process of integration is not adapted in this part of Africa. In accordance with the so-called Spaghetti Bowl effect of Bhagwati et al. (1998), the high number of trade agreements in Eastern and Southern Africa contributes to this bad performance in terms of income convergence.[19] Moreover, although this agreement was officially created since 1981, the economic cooperation process within COMESA is relatively recent in the extent that the free trade area and the customs union were established in 2000 and 2009, respectively. In addition, at date just a small number of countries does participate to these latter.

Table 3 displays the outcomes resulting from the panel unit root tests for the different convergence clubs presented in Table 1. If we use the economic structure criterion, there is no clubs convergence. The null of a unit root is not rejected by all the tests both for the absolute and conditional convergence hypothesis whatever the group considered (APPA, Non-APPA). Moreover, taking into account the presence of cross-sectional dependence does not change the results. The reject of the convergence

[19] All COMESA countries belong to at least another African trade arrangement. More precisely, five RIAs are concerned, namely the Indian Ocean Commission (IOC), the East African Community (EAC), the Southern African Development Community (SADC), the Economic Community of Central African States (ECCAS), the Arab Maghreb Union (AMU), Intergovernmental Authority for Development (IGAD) and the Cross-Border Initiative (CBI).

Table 2: Panel unit root tests – COMESA – 1950–2003.

References	LLC_1	LLC_2	IPS	BN_c	BN_i
COMESA average	3.82 (0.99)	1.43 (0.92)	3.04 (0.99)	−1.55 (0.50)	32.48 (0.80)
African average	3.38 (0.99)	2.31 (0.99)	2.62 (0.99)	−0.34 (0.92)	30.90 (0.85)
World average	8.88 (1.00)	3.46 (0.99)	6.22 (1.00)	1.20 (0.99)	41.13 (0.42)

* and ** Significant at the 5% and 10% level, respectively. The p-values are given in parentheses. LLC_1 and LLC_2 denote the Levin, Liu and Chin (2002) panel unit root test with no individual effects and with individual effects respectively. IPS denotes the Im, Pesaran and Shin (2003) unit root test with individual unit root processes. BN_c and BN_i denote the Bai and Ng (2004) second-generation unit root test for common factors ($ADF^c_{\hat{F}}$) and idiosyncratic shocks ($P^c_{\hat{\varepsilon}}$), respectively. Note that all these three last tests are done with individual effects.

for these two groups is not very surprising. The discrimination by the oil criterion is not sufficient to constitute homogeneous groups in the case of the COMESA. Several members reveal a production structure more diversified as for instance Egypt, Mauritius or Seychelles.

The grouping by the economic development criterion provides the more interesting findings. Two out of three groups are associated with an absolute income convergence trend. In effect, the null hypothesis of a unit root can be rejected at the 5% and 10% level for the LDC and HMHDI groups, respectively, from the panel unit root test with no individual effects LLC_1. This result implies that the level of per capita income of the poor countries in these groups catch-up with the one of the rich ones. Concerning the last one, the LHDI group, a divergent process seems to characterize the data, i.e. this group do not converge. That is not very surprising because of the strong economic development disparities which are still present in this group. Indeed, some countries as Zimbabwe, Kenya or Swaziland reveal HDI performances close to the upper limit of 0.6. Although their economic development levels stay relatively low, they do undoubtedly better than the fourteen other countries.

Thus, our work allows us to strongly support the theoretical insight. Economic development is crucial for improving the growth performances of an economy. This conjecture is more evident for the COMESA. Countries with good economic development conditions (Mauritius, Seychelles, Libya, Egypt) show a catching up process towards a high income average. But, countries with bad economic development conditions, i.e. sixteen out of twenty economies, converge towards a low income average. Thus, we can conclude from this study that there is an income

convergence process towards the bottom within the COMESA. Indeed, except for four countries, all the members of this regional agreement are locked into the poverty trap. Note that our results are conformed to the insights of the well-known "twin peaks" literature (Jones, 1997; Beaudry et al., 2005). This latter revealed that the shape of distribution of output per capita across countries has changed considerably over time. Particularly, since the beginning of the eighties, a clear twin-peaked shape had emerged with a cluster of rich countries and a cluster of poor countries. This structure seems to also characterize the COMESA area.[20]

Table 3: Panel unit root tests – Convergence clubs – 1950–2003.

Groups	LLC_1	LLC_2	IPS	BN_c	BN_i
Economic structure criterion					
APPA	-0.15 (0.44)	-0.61 (0.27)	0.29 (0.61)	-1.29 (0.63)	2.56 (0.98)
NON-APPA	4.34 (1.00)	3.49 (0.99)	5.83 (1.00)	0.37 (0.98)	37.45 (0.16)
Economic development criterion					
LHDI	-0.32 (0.38)	1.42 (0.92)	2.70 (0.99)	-1.67 (0.45)	27.83 (0.68)
HMHDI	-1.42^{**} (0.08)	–	–	–	–
LDC	-2.45^{*} (0.01)	–	–	–	–

* and ** Significant at the 5% and 10% level, respectively. The p-values are given in parentheses. LLC_1 and LLC_2 denote the Levin, Liu and Chin (2002) panel unit root test with no individual effects and with individual effects, respectively. IPS denotes the Im, Pesaran and Shin (2003) unit root test with individual unit root processes. BN_c and BN_i denote the Bai and Ng (2004) second-generation unit root test for common factors ($ADF^c_{\hat{F}}$) and idiosyncratic shocks ($P^c_{\hat{\varepsilon}}$), respectively. Note that all these three last tests are done with individual effects.

5 Conclusion

In this paper, we proposed to detect the possibility of stochastic convergence of real per capita GDP for a set of Eastern and Southern African countries, all members of the COMESA's trade agreement. Using the panel unit-root tests developed by Levin et al. (2002), Im et al. (2003) and Bai and Ng (2004), our results rejected the presence of stochastic convergence for the whole COMESA. Contrary to the conceptual conclusion

[20] We have obtained the same results by using panel unit root tests that allow for structural breaks (Carrion-i-Silvestre et al., 2005) and panel unit root tests that allow changes in persistence (Costantini and Gutierrez, 2007). Note that the detected breaks are not associated with the establishment of COMESA.

of Venables (2003) about South-South integration, the lack of convergence in our case does not imply that regional integration does not stimulate the setting up of a catching up process. Actually, in our point of view, this bad performance results from the so-called "Spaghetti Bowl" effect of Bhagwati et al. (1998). Thus, this region needs a strategy based on a rationalization of the number of trade agreements before deepening the trade and financial relations between the different economies.

However, in the extent that most COMESA countries are largely heterogeneous, we tried to put forward the potential existence of convergence clubs within the trade agreement by two criteria, namely (i) the economic structure (dependence from oil production) and (ii) the degree of global economic development. Two main findings emerged from the results. Firstly, no evidence of stochastic absolute and conditional income convergence holds for the economic structure criteria. Secondly, the testing procedures highlighted strong support for absolute income convergence for two groups (HMHDI, LDC) belonging to the economic development criterion. This result led us to conclude that a convergence process towards the bottom is at work for the COMESA members, except for the most four developed countries, that is Mauritius, Seychelles, Libya and Egypt. This result corroborates the findings of the New Growth Theories in the extent that initial economic development conditions determine the long-run economic growth processes. A related outcome is the necessary intervention of both local governments and international institutions to create a climate of sustainable development and get these under-development economies out of the poverty trap. Indeed, a poor country can not escape from poverty without the implementation of policy initiatives to change initial conditions in such a way that this country could jump from its low level but stable initial equilibrium to another stable one but characterized by a higher level of income.[21]

[21] A review for the political strategies available to lift a poor economy out of its poverty trap is given by Berthélemy (2005).

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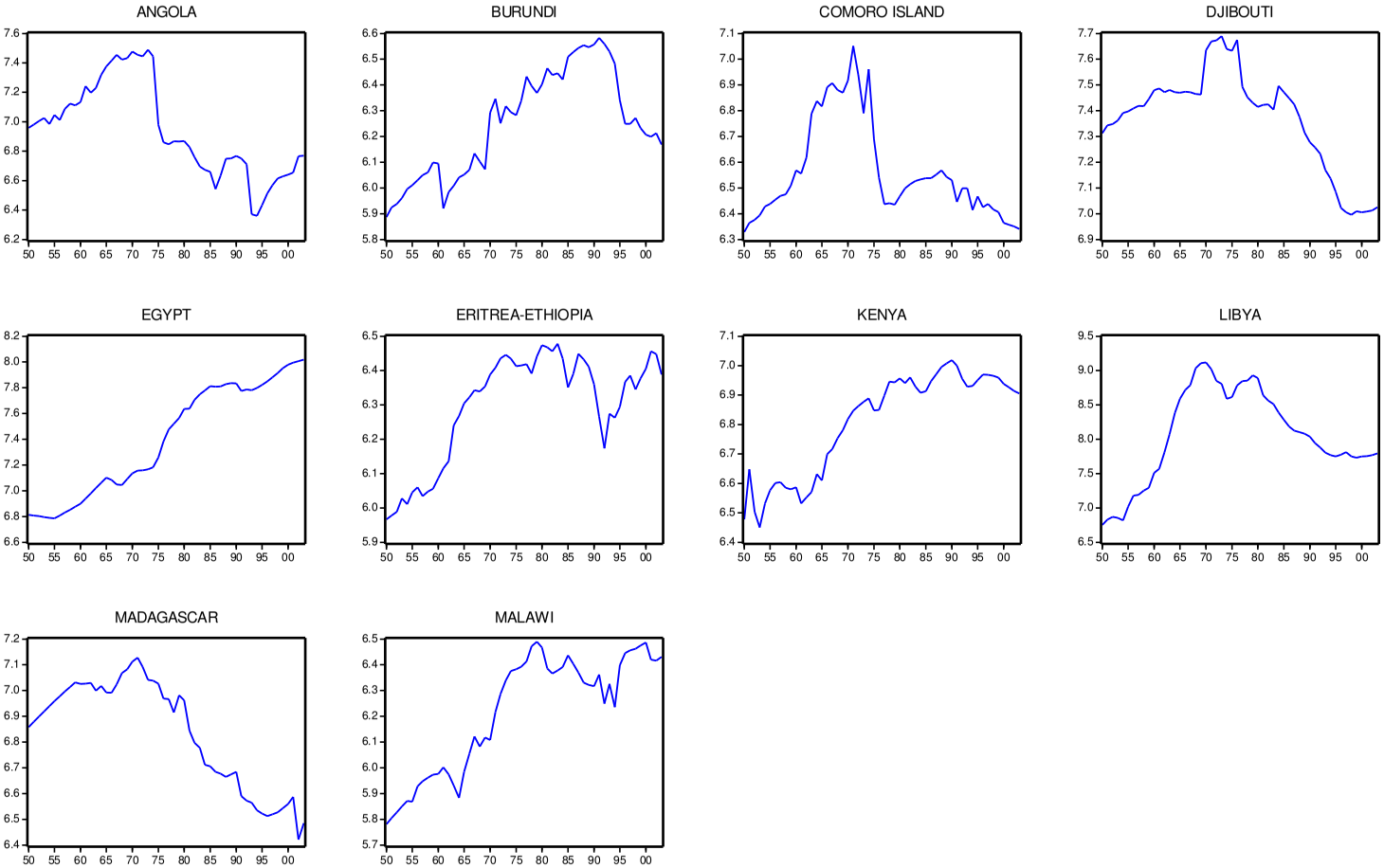
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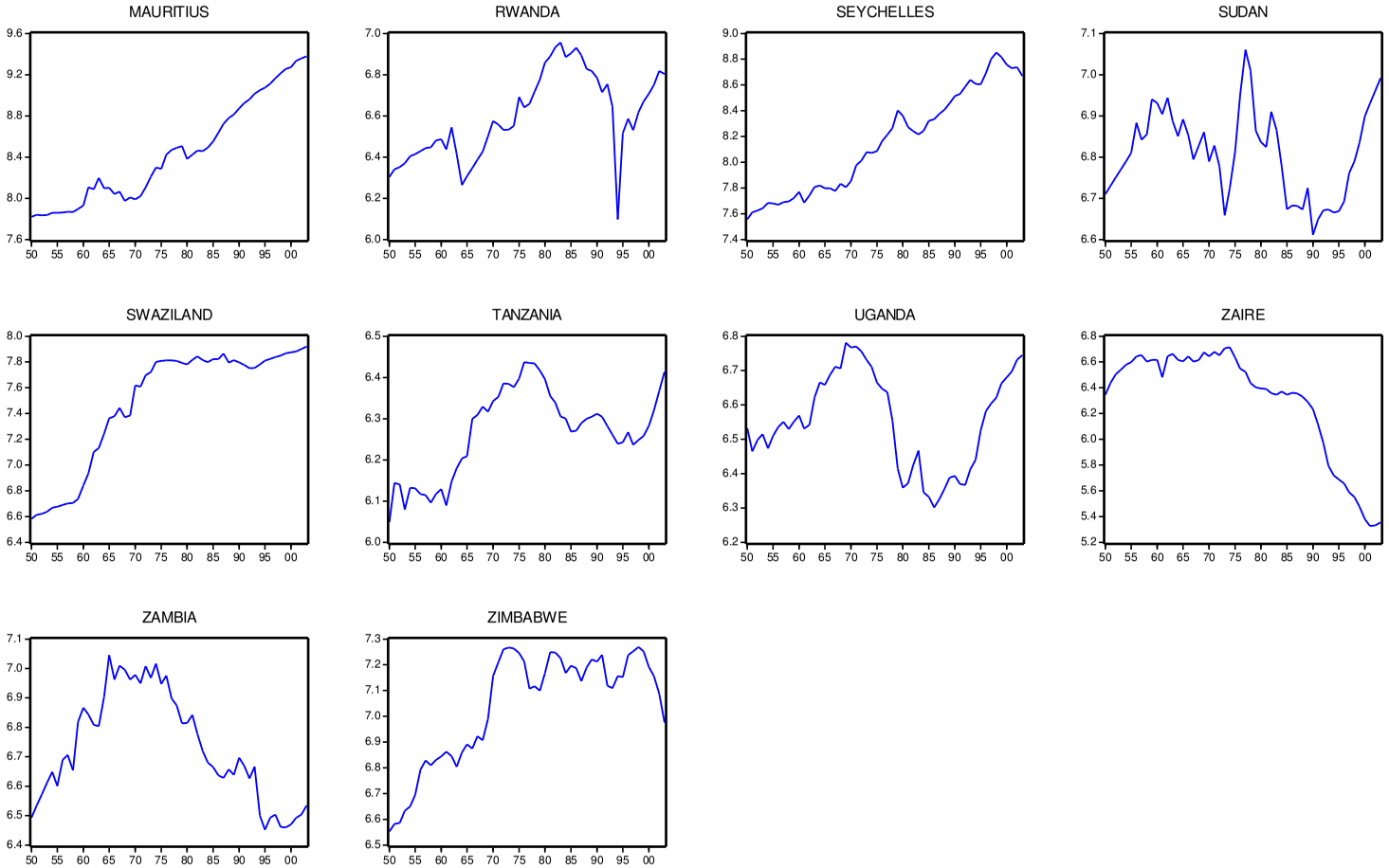
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